IMPACTS OF TEXTILE MATERIALS ON THE MAIN PROPERTIES OF WEFT KNITTING FABRIC MADE FROM BAMBOO AND POLYAMIDE YARNS

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Abstract

This article presents the evaluation of the influence of textile materials on some physical and mechanical properties of knit fabrics concerning break load, elongation at break, determination of capillarity, air permeability, stretch properties, and elasticity. The evaluations are performed on 3 fabric samples with composition ratio: 70% bamboo/ 20% polyamide/ 10% spandex, 100% polyamide, 80% bamboo/ 20% polyamide, provied by local manufacturers for testing. The research uses the standard test methods of determination of breaking load and elongation at break to TCVN 5795:1994, capillarity to TCVN 5073:1990, air permeability of textile fabrics to TCVN 5092:2009 (ASTM D 73:2004), stretch properties of knitted fabrics having low power to (ASTM D2594), textiles - stretchability of fabrics and ribbons to NF G07-196. Experimental results are synthesized and calculated to compare and analyze the data obtained for each sample of test cloth and the results showed that textile materials and some structural parameters affect some physical and mechanical properties of knit fabrics.

Keywords: *Knitted fabric; bamboo polyamide blend; break load and elongation at break; determination of capillarity; air permeability; stretch properties; elasticity.*

1. Introduction

In the textile industry, knitted fabric accounts for a significant proportion of raw material supply in both international and domestic markets. Along with the development of the fashion industry, the demand for superior performance features of fabrics is increasingly high, notably for knitted fabrics. Knitted fabrics are created by interlinking yarn loops according to a specific pattern. They are characterized by high elasticity and excellent flexibility. Changes in the structural elements of the fabric and the textile materials used will influence the load and elongation at break of knitted fabrics.

The composition of textile materials and the structural parameters of fabric, including yarn density, fabric weight in g/m², fabric thickness, and knitting pattern,

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will also affect the mechanical and physical properties of knitted fabrics when these factors change.

N. T. Trang *et al.* [1] conducted a study on the effects of certain structural parameters of PA/spandex weft-knitted fabrics on some mechanical and physical properties after the knitting and finishing processes. The study utilized three types of fabrics with a fiber composition of 90% polyamide and 10% spandex, and different knitting patterns, to examine the impact of structural parameters such as knitting pattern, density, thickness, and weight on fabric properties, including moisture absorption and breathability after knitting and finishing. The results showed that yarn density affects the fabric's breathability and moisture absorption: lower yarn density results in higher breathability and moisture absorption. However, this also depends on the knitting pattern. For patterns that reduce the size of air-permeable openings in the fabric, the breathability of the fabric decreases.

B. H. Tung [2] studied the effects of structural parameters of knitted fabrics on their drapeability. The study selected four groups of knitted fabrics produced at Hung Cuong Textile Company, Ha Tay. Each fabric group was knitted using the same knitting pattern, the same yarn type (Ne30/1), and the same material, but with variations in the 100-loop yarn length ranging from 240 meters to 300 meters and the fabric weight from 100 g/m² to 150 g/m². Experimental research was conducted to: determine the yarn loop modulus, assess the drapeability of knitted fabrics, identify the loop density, measure the loop length within the fabric, determine the fabric weight in g/m², and apply mathematical regression methods. The results indicated that the fabric weight is directly proportional to the drape coefficients of both the technical face and technical back of the experimental fabric samples.

C. D. Huong *et al.* [3] conducted a study on the effects of spandex fiber content on the mechanical and physical properties of single jersey fabric used for women's sports leggings. The study utilized four single jersey fabric samples knitted from CVC yarn (40/60 Polyester/Cotton) with spandex content ratios of 100%, 50%, 33%, and 25% for experimentation. The experimental research methods included: determining fabric density according to TCVN 5794:1994, measuring fabric thickness according to ISO 5084, measuring fabric weight according to TCVN 4897-89, and evaluating fabric transverse elongation according to TCVN 5795. The results showed that fabric thickness, weight, density, and transverse elongation increased with higher spandex fiber content while breathability tended to decrease as the spandex content increased.

Worldwide, numerous studies have been conducted on the influence of structural parameters on the mechanical and physical properties of knitted fabrics.

C. Prakash *et al.* [4] conducted a study on the comfort properties of knitted fabrics. The fabric samples used in the study had different compositions: 100% cotton, 100% bamboo, and cotton/bamboo blends (50/50, 67/33, 33/67 cotton/bamboo). The fabrics were knitted with varying tightness levels: loose, medium, and tight, but maintained the same fabric density. The results showed that the moisture absorption capacity of the fabric increased as the bamboo fiber content in the fabric increased.

S. Sahu and A. Goel [5] conducted a study on the effects of spandex yarn count on the properties of single jersey fabric. The study used two types of single jersey fabrics made from core-spun yarns with spandex as the core and lyocell as the outer sheath, having fineness levels of 20D/22dtex and 40D/44dtex (spandex/lyocell), respectively. The results showed that fabric thickness, weight, and density increased with the increase in the fineness of the elastane core yarn.

In this study, the authors selected three types of knitted fabrics with different compositions, made from bamboo/polyamide/spandex, polyamide, and bamboo/polyamide, to investigate the impact of textile materials on certain properties of knitted fabrics: tensile strength and elongation at break, capillarity, breathability, stretch and recovery, and fabric elastic modulus.

2. Experimental research method

2.1. Research objectives

The study used three types of knitted fabrics with different fabric compositions: a blend fabric consisting of bamboo/polyamide/spandex in a ratio of 70/20/10; 100% polyamide fabric; and a bamboo/polyamide blend in a ratio of 80/20, all knitted in a single jersey pattern. The fabric samples were provided by Yen My Export Textile Company - Hanoi Fashion Trading and Service Joint Stock Company, and were coded as BPAS, PA, and BPA, respectively. The technical specifications of the experimental fabric samples are presented in Tab. 1.

Tab. 1. Technical specifications of the fabric samples used in the study

No.	Fabric sample coding	Fabric composition (%)	Fabric weight (g/m^2)	Fabric density (yarns/10 cm)		Thickness (mm)
				Vertical (wales/10 cm)	Horizontal (courses/10 cm)	
1	B/PA/S	70/20/10	343	330	280	0.835
2	PA	100	197	290	250	0.630
3	B/PA	80/20	186	141	200	0.560

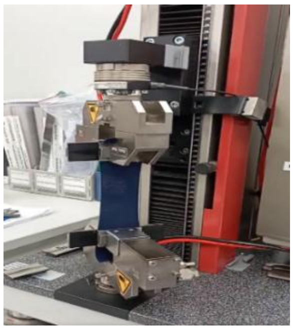
2.2. Research content

Evaluate the impact of textile materials on certain properties of knitted fabrics: Determination of breaking load and elongation at break, determination of capillarity; determination of air permeability; determination of the stretch and recovery; determination of elasticity.

2.3. Research methods

The fabric samples were taken according to the standard TCVN 5791:1994 [6] and conditioned according to ISO 139:2005 (TCVN 1748:2007) for at least 24 hours prior to each test. The breaking load and elongation at break of the knitted fabrics were determined according to TCVN 5795:1994 [7]. The capillarity of the samples was evaluated using the method specified in TCVN 5073:1990 [8]. Air permeability testing was conducted following TCVN 5092:2009 and ASTM D 737:2004 [9]. The stretch and recovery of low-power knitted fabrics were assessed using the standard method ASTM D 2594 [10]. The elasticity of the fabrics was determined in accordance with NF G07-196 [11], which describes the test method for stretchability of fabrics and ribbons. The main equipment used in the experimental procedures is illustrated in Fig. 1.

Capillary measurement device



Breaking load and elongation at break device and elastic modulus testing device

Stretch and recovery measurement device

Air permeability testing device

Fig. 1. Main equipment used in the research.

3. Results and discussion

3.1. Influence of textile materials on breaking load and elongation at break of knitted fabrics

The three types of knitted fabrics with different material compositions were prepared according to TCVN 5791:1994. Subsequently, the breaking load and elongation at break of the fabrics were determined according to TCVN 5795:1994 [7]. The results are presented in Figs. 2, 3.

The results in Fig. 2 show that the fabric composition affects its breaking load in the wale and course directions, specifically:

Among the three fabric samples (B/PA/S, PA, B/PA), the B/PA/S sample has the highest the breaking load in both the wale direction and course direction with values of 303.8 N and 309.9 N, respectively. The PA sample shows an average tensile strength in the wale and course directions of 265.7 N and 267.1 N, respectively. The B/PA sample has the lowest tensile strength in both the wale and course directions at 186 N and 186.3 N, respectively.

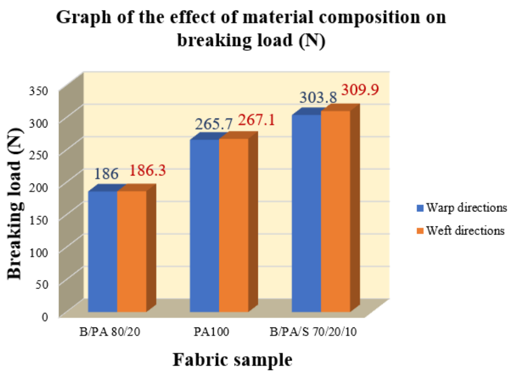


Fig. 2. Impact of material composition on breaking load.

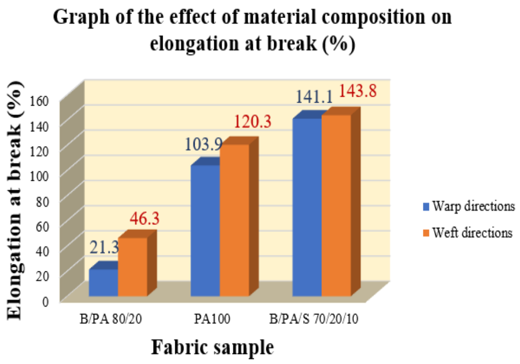


Fig. 3. Impact of material composition on elongation at break.

However, for all three fabric samples, the breaking load in the course direction is slightly higher than in the wale direction, but the difference is not significant.

The results in Fig. 3 indicate the elongation at break in the wale and course directions as follows:

Among the group of knitted fabrics (BPAS, PA, BPA), the BPAS sample has the highest elongation at break in the wale and course directions with values of 141.1% and 143.8%, respectively. The PA sample shows moderate elongation at break in the wale and course directions with values of 103.9% and 120.3%, respectively. The BPA sample has the lowest elongation at break in the wale and course directions at 21.3% and 46.3%, respectively.

This result indicates that the material composition of the fabric influences its breaking load and elongation at break in both wale and course directions. The BPAS fabric sample exhibits the highest tensile strength and elongation at break, primarily due to its composition of 10% spandex, 70% bamboo, and 20% polyamide. The high mechanical strength of spandex fibers contributes to the superior breaking load and elongation at break of the BPAS fabric compared to the other samples. The PA fabric sample ranks second in terms of breaking load and elongation at break, owing to its 100% polyamide composition. Polyamide, as a synthetic fiber, has higher breaking load and elongation at break than natural fibers due to its molecular structure and chemical properties. Meanwhile, the BPA fabric sample has the lowest breaking load and elongation at break among the three experimental fabrics, as it contains 80% bamboo fiber. Bamboo, being a natural fiber, has lower mechanical strength, resulting in the inferior breaking load and elongation at break of the BPA fabric.

Thus, the material composition of the fabric affects its breaking load and elongation at break. Adding bamboo fiber to polyamide significantly alters the mechanical properties of the fabric, reducing its breaking load and elongation at break compared to fabrics with 100% polyamide, as natural fibers have lower mechanical strength than synthetic fibers. However, adding 10% spandex to the BPA fabric sample increased its breaking load and elongation at break in the wale direction by 85%. Therefore, the addition of spandex to the bamboo and polyamide fabric significantly improved its mechanical properties, resulting in a higher breaking load and elongation at break.

3.2. Influence of textile materials on the capillarity of knitted fabrics

Three types of knitted fabrics with different material compositions were prepared according to TCVN 5791:1994, and then the capillarity of the fabrics was determined according to TCVN 5073:1990 [8].

3.2.1. Capillarity results in the wale direction of the fabric

The capillarity measurement results in the wale direction are shown in Fig. 4.

The results in Fig. 4 show that among the knitted fabric group (BPAS, PA, BPA), the BPAS fabric sample has the highest capillarity in the wale direction at 0.41 (cm/min). The BPA fabric sample has an average capillarity of 0.15 (cm/min) in the wale direction. The PA fabric sample has the lowest capillarity in the wale direction at 0.03 (cm/min).

Thus, the material composition affects the capillarity in the wale direction. Bamboo has the best absorption capacity due to the cross-sectional structure of the fiber, which contains many voids and micro-pores, enabling it to absorb moisture. Therefore, fabric samples with bamboo content will have better capillarity. In contrast, polyamide has poor moisture absorption with most of the moisture remaining on the surface. As a result, the higher the percentage of polyamide in the fabric, the lower the capillarity. Hence, blending polyamide with bamboo reduces the capillarity of the fabric.

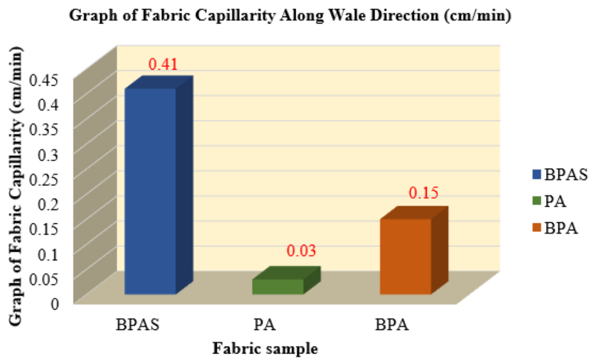


Fig. 4. Graph of fabric capillarity along wale direction.

3.2.2. Capillarity results in the course direction of the fabric

The capillarity measurement results in the course direction are shown in Fig. 5.

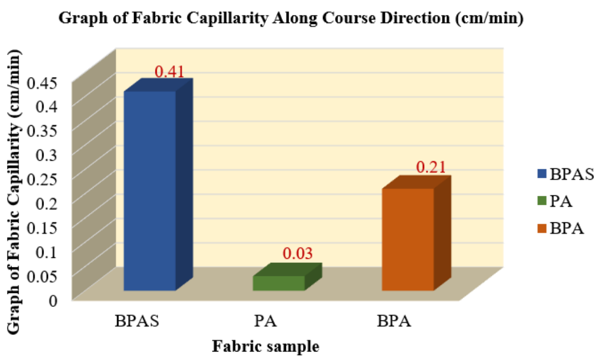


Fig. 5. Graph of capillarity of experimental fabric samples in the course direction.

The results in Fig. 5 show that among the knitted fabric group (BPAS, PA, BPA), the BPAS fabric sample has the highest capillarity in the course direction at 0.41 (cm/min). The BPA fabric sample has an average capillarity of 0.21 (cm/min) in the course direction. The PA fabric sample has the lowest capillarity in the course direction at 0.03 (cm/min).

The difference in capillarity in the course direction among the three fabric samples may be due to the varying ratios of bamboo, spandex, and polyamide, which affect the capillarity in the course direction. The BPAS fabric contains 70% bamboo while the BPA fabric contains 80% bamboo. However, the capillarity of the BPAS fabric is still higher than that of the BPA fabric because the course density of the BPAS fabric is higher than that of the BPA fabric. The course density of the BPAS and BPA samples are 280 and 200, respectively. A higher course density increases the proportion of bamboo fibers in the fabric, resulting in better capillarity. Finally, the PA sample with 100% polyamide has the lowest capillarity. This is consistent with the characteristics of these fibers, as bamboo has good moisture absorption while polyamide has poor moisture absorption.

Theoretically, it can be observed that when the fabric has a higher fiber density (more fibers per unit area), the capillarity of the fabric increases because the distance between fibers decreases, which improves the ability of the fibers to transmit liquid on their surfaces, and vice versa.

In summary, the material composition affects the capillarity in the course direction. Bamboo has the best absorption capacity due to the cross-sectional structure of the fiber, which contains many voids and micro-pores, allowing it to absorb moisture. Therefore, fabric samples with bamboo content will have better capillarity. In contrast, polyamide has poor moisture absorption with most of the moisture remaining on the surface. As a result, the higher the percentage of polyamide in the fabric is, the lower the capillarity is. Hence, blending polyamide with bamboo reduces the fabric's capillarity.

3.3. Influence of textile materials on the air permeability of knitted fabrics

Three types of knitted fabrics with different material compositions were prepared according to TCVN 5791:1994, and then the air permeability of the fabrics was determined according to TCVN 5092:2009 [9]. The results in Fig. 6 show that among the knitted fabric group (BPAS, PA, BPA), the BPA fabric sample has the highest air permeability at 1689 ($L/m^2/s$). The PA fabric sample has an average air permeability of 219.3 ($L/m^2/s$) while the BPAS fabric sample has the lowest air permeability at 96.18 ($L/m^2/s$).

The BPA fabric sample has the highest air permeability due to its 80% bamboo content. In terms of material composition, the higher the bamboo content in the fabric, the higher the air permeability, as the cross-section of bamboo fibers contains many voids and micro-pores that enable good moisture absorption and air permeability. The BPAS fabric sample contains 70% bamboo but has the lowest air permeability among the three fabric samples, even lower than the 100% polyamide PA fabric sample. According to the fabric structure parameters in Tab. 1, the BPAS fabric has the highest thickness, weight, and density compared to the other two samples. Theoretically, as the thickness increases, the air permeability of the fabric tends to decrease because an increase in thickness leads to higher weight and density, reducing the size of the pores on the fabric surface. These results in a tighter fabric surface and, consequently, reduced air permeability.

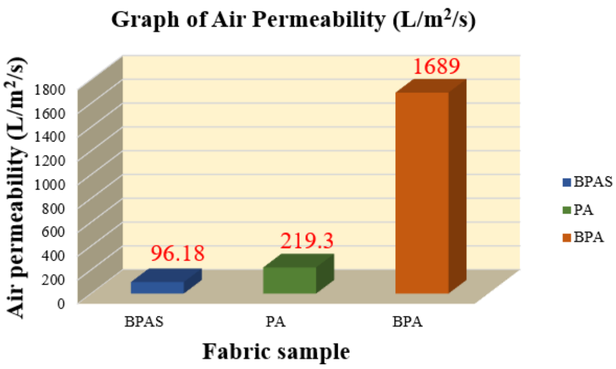


Fig. 6. Air permeability chart of the experimental fabric samples.

In summary, the material composition affects the air permeability of the three experimental fabric samples. Additionally, fabric structure parameters also have a significant impact on the fabric's air permeability: Thickness is inversely proportional to air permeability. As the fabric thickness increases, the air permeability tends to decrease. The fabric weight affects its air permeability as well with weight being inversely proportional to air permeability. As the fabric weight increases, the air permeability tends to decrease. Increasing fiber density leads to a reduction in fabric air permeability.

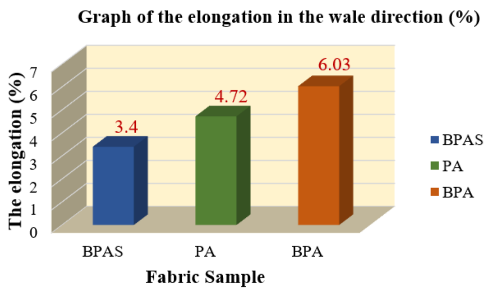
3.4. Influence of textile materials on the elongation and recovery of knitted fabrics

The 3 types of knitted fabrics with different material compositions were prepared according to TCVN 5791:1994, and then the elongation of the knitted fabrics under low load was determined according to ASTM D2594 [10].

3.4.1. Influence of textile materials on the elongation and recovery of knitted fabrics in the wale direction

The elongation and recovery results in the wale direction are shown in Figs. 7, 8. The results in Fig. 7 show that the BPA fabric sample (B/PA 80/20) has the highest elongation in the wale direction at 6.03%. The PA fabric sample (PA100) has the second-highest elongation in the wale direction at 4.72%. The BPAS fabric sample (B/PA/S 70/20/10) has the lowest elongation in the wale direction at 3.4%.

The material composition in the fabric is one of the factors causing the variation in elongation in the wale direction among the three fabric samples. For the BPA fabric sample, which contains 80% bamboo and 20% polyamide, this blend is primarily made up of natural fibers, which have poor elasticity. Therefore, the change in length between the two benchmarks (after stretching and after recovery) for the BPA fabric is the largest, resulting in the highest elongation. The PA fabric sample has the second-highest elongation due to its 100% polyamide content. This synthetic fiber has higher elasticity than natural fibers, which is why the elongation after stretching and recovery in the wale direction is lower than that of the BPA fabric. As for the BPAS fabric sample, which contains bamboo, polyamide, and 10% spandex, the addition of spandex improves its elasticity. As a result, the change in length between the two benchmarks (after stretching and after recovery) is the smallest among the three samples, resulting in the lowest elongation.



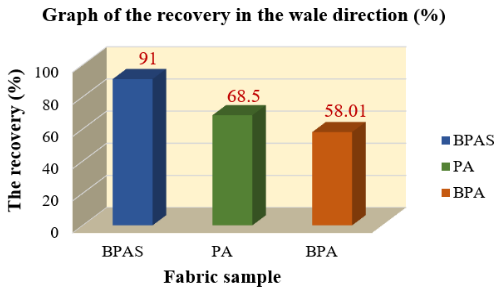


Fig. 7. Fabric elongation chart in wale direction. Fig. 8. Fabric recovery chart in wale direction.

The results in Fig. 8 show that the BPAS fabric sample has the highest recovery in the wale direction at 91%. The PA fabric sample has the second-highest recovery in the wale direction at 68.5%. The BPA fabric sample has the lowest recovery in the wale direction at 58.01%.

The differences in recovery in the wale direction among the three fabric samples are completely logical. This is because the recovery in the wale direction is inversely proportional to elongation in the same direction; the higher the elongation is, the lower the recovery is. Referring to Fig. 8, we can observe that the elongation of the three fabric samples BPAS, PA, and BPA increases from low to high at 3.4%, 4.72%, and 6.03%, respectively. According to theory, the lower the elongation (i.e., the smaller the change in length between the two benchmarks after stretching and after recovery), the higher the recovery. Therefore, the BPAS fabric will have the highest recovery, the PA fabric will have the second-highest recovery, and the BPA fabric will have the lowest recovery.

In summary, the material composition affects the elongation and recovery in the wale direction of knitted fabrics. Adding bamboo to polyamide significantly changes the mechanical properties of the fabric, increasing elongation and decreasing recovery, as natural fibers have lower elasticity than synthetic fibers. However, adding 10% spandex to the BPA fabric sample increased the fabric's elasticity, resulting in decreased elongation and increased recovery. Therefore, the combination of bamboo and polyamide fabrics, when supplemented with spandex, greatly improved the mechanical properties of the fabric, leading to higher recovery.

3.4.2. Influence of fiber materials on the elongation and recovery of knitted fabrics in the course direction

The results of the elongation and recovery measurements in the course direction are shown in Figs. 9, 10.

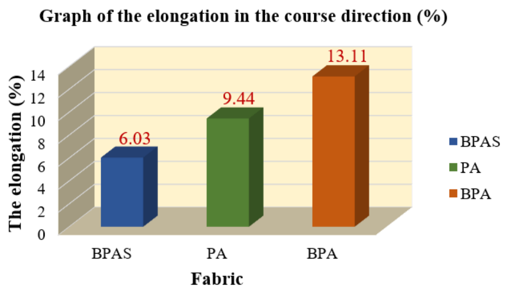


Fig. 9. Fabric elongation chart in course direction.

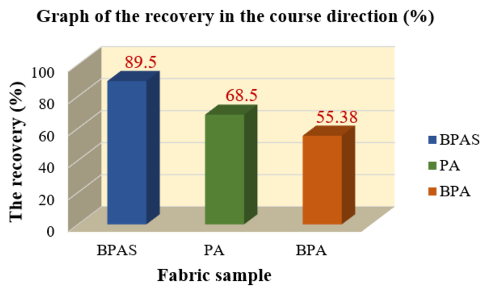


Fig. 10. Fabric recovery chart in course direction.

The results in Fig. 9 show that the BPA fabric sample (B/PA 80/20) has the highest elongation in the course direction, reaching 13.11%. The PA fabric sample (PA100) has the second-highest elongation in the course direction at 9.44%. The BPAS fabric sample (B/PA/S 70/20/10) has the lowest elongation in the course direction at 6.03%.

The fiber composition in the fabric is one of the factors causing the variation in elongation in the course direction among the three fabric samples. For the BPA fabric sample containing 80% bamboo and 20% polyamide, this blend primarily consists of natural fibers, which have poor elasticity. Therefore, the length change between the two benchmarks (after stretching and after recovery) for the BPA fabric sample is the largest, resulting in the highest elongation. The PA fabric sample has the second-highest elongation due to its 100% polyamide composition. This synthetic fiber has better elasticity compared to natural fibers, so the elongation after stretching and recovery in the course direction is lower in the PA fabric sample than in the BPA fabric. For the BPAS sample, which contains bamboo, polyamide, and 10% spandex, the addition of spandex improves the fabric's elasticity. As a result, the length change between the two benchmarks (after stretching and after recovery) for the BPAS fabric is the smallest among the three samples, resulting in the lowest elongation.

From the results in Fig. 10, it can be seen that the BPAS fabric sample has the highest recovery elongation in the course direction, reaching 89.5%. The PA fabric sample has the second-highest recovery elongation in the course direction at 68.5%. The BPA fabric sample has the lowest recovery elongation in the course direction, reaching 55.38%.

The difference in recovery elongation in the course direction among the three fabric samples is completely reasonable. This is because the recovery elongation in the course direction is inversely proportional to the elongation in the same direction. According to Fig. 11, the elongation in the course direction for the three fabric samples BPAS, PA, and BPA is in increasing order: 6.03%, 9.44%, and 13.11%. Theoretically, the lower the elongation (meaning the smaller the length change between the two benchmarks after stretching and recovery), the higher the recovery. Therefore, the BPAS fabric will have the highest recovery, the PA fabric will have the second-highest recovery, and the BPA fabric will have the lowest recovery.

In conclusion, the material composition affects the elongation and recovery elongation in the course direction of knitted fabrics. Adding bamboo fiber to polyamide significantly alters the mechanical properties of the fabric, resulting in increased elongation and decreased recovery elongation, as natural fibers have lower elasticity compared to synthetic fibers. However, the addition of 10% spandex to the BPA fabric sample improved its stretchability, leading to reduced elongation and increased recovery. Therefore, the combination of bamboo and polyamide fibers with the addition of spandex greatly enhances the fabric's mechanical properties, resulting in higher recovery elongation.

3.5. Influence of fabric materials on the elastic modulus of knitted fabrics

Three types of knitted fabrics with different material compositions, coded as BPAS, PA, and BPA, were prepared according to TCVN 5791:1994, and the elastic deformation modulus (E) of the fabric in the course direction was determined according to NF G07-196 [11]. The results are shown in Fig. 11.

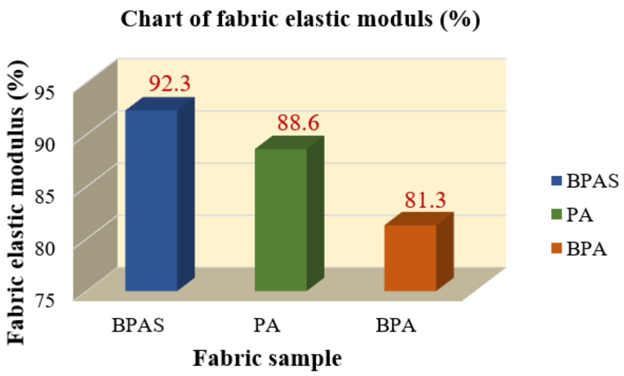


Fig. 11. Elastic modulus E chart in the course direction of the experimental fabric samples.

From the results in Fig. 11, it can be observed that the BPAS fabric sample has the highest elasticity in the course direction, reaching 92.3%. The PA fabric sample has the second-highest elasticity in the course direction at 88.6%. The BPA fabric sample has the lowest elasticity at 81.3%.

Thus, the difference in elasticity in the course direction of the three fabric samples may be due to the varying blend ratios of bamboo, spandex, and polyamide, which affect the fabric's elasticity in the course direction. The BPAS fabric sample contains 10% spandex, giving it the highest modulus of elasticity. The PA fabric sample, containing 100% polyamide - a synthetic fiber with higher elasticity than natural fibers - has the second-highest modulus of elasticity. Last, the BPA sample, containing 80% bamboo (a natural fiber with lower elasticity), has the lowest modulus of elasticity.

4. Conclusion

The study used three types of knitted fabrics with different material compositions: one bamboo/polyamide/spandex fabric with a ratio of (B/PA/S 70/20/10); one 100% polyamide fabric; and one bamboo/polyamide fabric with a ratio of (B/PA 80/20) to evaluate the impact of the material composition on various fabric properties, specifically:

The BPAS fabric (B/PA/S 70/20/10) has the highest tensile strength, reaching 303.8 N in the wale direction and 309.9 N in the course direction. The BPA fabric (B/PA 80/20) has the lowest tensile strength in both the wale and course directions with values of 186N and 186.3 N, respectively.

Among the tested samples, the BPAS fabric has the highest elongation at break, reaching 141.1% in the wale direction and 143.8% in the course direction. The BPA fabric (B/PA 80/20) has the lowest elongation at break with values of 21.3% in the wale direction and 46.3% in the course direction. Regarding capillary action, the BPAS fabric has the highest capillary action in both the wale and course directions, achieving 0.41 (cm/min) in both directions. The PA fabric has the lowest capillary action with values of 0.03 (cm/min) in both directions. In terms of air permeability, the BPA fabric has the highest air permeability at 1689 (L/m²/s) while the BPAS fabric has the lowest air permeability at 96.18 (L/m²/s). The BPA fabric (B/PA 80/20) has the highest elongation at 6.03% in the wale direction and 13.11% in the course direction. The BPAS fabric (B/PA/S 70/20/10) has the lowest elongation in both the wale and course directions with values of 3.4% and 6.03%, respectively. Next, the BPAS fabric has the highest recovery after elongation with values of 91% in the wale direction and 89.5% in the course direction. The BPA fabric (B/PA 80/20) has the lowest recovery after elongation with values of 58.01% in the wale direction and 55.38% in the course direction. Lastly, the BPAS fabric has the highest elasticity in the course direction at 92.3% while the BPA fabric has the lowest elasticity at 81.3%.

The results of this study provide a preliminary basis and offer suggestions for fabric manufacturers and designers in selecting appropriate materials for textile product design, meeting user needs while enhancing quality and gaining a competitive advantage in the market.

References

[1] N. T. Trang và nnk, "Khảo sát ảnh hưởng của một số thông số cấu trúc của vải dệt kim đan ngang PA/Spandex sau quá trình dệt và hoàn tất đến một số tính chất cơ lý", *Tập san Sinh viên nghiên cứu khoa học,* Số 10, tr. 196-199, 2020.

[2] B. H. Tùng, "*Nghiên cứu ảnh hưởng của các thông số cấu trúc vải dệt kim đến khả năng rủ của nó*", Luận văn thạc sĩ, Trường Đại học Bách khoa Hà Nội, 2012.

[3] C. D. Hương và N. T. T. Trinh, "Nghiên cứu ảnh hưởng của tỷ lệ thành phần sợi spandex tới các tính chất cơ lý của vải single jersey dệt từ sợi CVC sử dụng cho quần thể thao legging nữ", *Tạp chí Khoa học và Công nghệ,* Trường Đại học Công nghiệp Hà Nội, Số 50, tr. 83-85, 2019.

[4] C. Prakash *et al.*, "Study of thermal comfort properties of cotton/regenerated bamboo knitted fabrics", *African Journal of Basic & Applied Sciences*, Vol. 4, No. 2, pp. 60-66, 2012. DOI: 10.5829/idosi.ajbas.2012.4.2.1032

[5] S. Sahu and A. Goel, "Effect of spandex denier on structural properties of single jersey knitted fabric", *International Journal of Engineering Sciences & Research Technology*, Vol. 6, No. 9, pp. 407-412, 2017. DOI: 10.5281/zenodo.892126

[6] *Tiêu chuẩn về Vải dệt kim*, Tiêu chuẩn Việt Nam TCVN 5791:1994, Hà Nội, 1994.

[7] *Tiêu chuẩn về Vải dệt kim - Phương pháp xác định độ bền kéo đứt và độ giãn đứt*, Tiêu chuẩn Việt Nam TCVN 5795:1994, Hà Nội, 1994.

[8] *Tiêu chuẩn về Vải dệt thoi - Phương pháp xác định độ mao dẫn*, Tiêu chuẩn Việt Nam TCVN 5073:1990, Hà Nội, 1990.

[9] *Vật liệu dệt - Vải dệt - Phương pháp xác định độ thoáng khí,* Tiêu chuẩn quốc gia TCVN 5092:2009 (ASTM D 737:2004), Hà Nội, 2009.

[10] *Method for Determining Fabric Elongation under Light Tension*, ASTM D2594 standard, 2021.

[11] *Method for Determining the Elastic Modulus E of Fabric in the Horizontal Direction*, NF G07-196 standard, 2001.

ẢNH HƯỞNG CỦA NGUYÊN LIỆU DỆT TỚI MỘT SỐ TÍNH CHẤT CỦA VẢI DỆT KIM ĐAN NGANG TỪ SỢI TRE VÀ POLYAMIDE

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Tóm tắt: Bài báo trình bày việc đánh giá ảnh hưởng của nguyên liệu dệt tới một số tính chất của vải dệt kim: độ bền kéo đứt và giãn đứt, độ mao dẫn, độ thoáng khí, độ giãn và độ phục hồi giãn, mô đun đàn hồi trên 3 mẫu vải có thành phần: 70% tre/ 20% polyamide/ 10% spandex, 100% polyamide, 80% tre/ 20% polyamide được cung cấp bởi các nhà sản xuất trong nước để làm thực nghiệm. Sử dụng phương pháp nghiên cứu thực nghiệm để: Xác định độ bền kéo đứt và độ giãn đứt của vải dệt kim theo tiêu chuẩn TCVN 5795:1994; xác định độ mao dẫn của vải theo tiêu chuẩn TCVN 5073:1990; xác định tính thoáng khí theo tiêu chuẩn TCVN 5092:2009 ASTM D 73:2004; xác định độ giãn của vải dệt kim dưới tải trọng thấp (ASTM D2594); Phương pháp xác định mô đun đàn hồi của vải theo hướng ngang theo tiêu chuẩn NF G07-196. Các kết quả thí nghiệm được tổng hợp và tính toán bằng phần mềm Microsoft Excel. Từ đó so sánh và phân tích các kết quả dựa trên số liệu thu được của từng mẫu vải thử, thấy rằng nguyên liệu dệt và thông số cấu trúc của vải có ảnh hưởng đến một số tính chất cơ lý của vải dệt kim.

Từ khóa: *Vải dệt kim; tre pha polyamide; độ bền kéo đứt và độ giãn đứt; độ mao dẫn; độ thoáng khí; độ giãn và phục hồi giãn; mô đun đàn hồi.*

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